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THE RELATIONSHIP OF DIAMETER TO HEIGHT OF ATTACK IN LODGEPOLE PINE INFESTED BY MOUNTAIN PINE BEETLE

Donn B. Cahill
Division of Forest Insect Research

INTRODUCTION

Deciding how much of an infested tree must be sprayed to effect satisfactory kill is a problem during chemical control projects against mountain pine beetle, Dendroctonus monticolae Hopk., in lodgepole pine. Obviously, a major consideration is height above ground of successful bark beetle attack. On most projects it is desirable to spray all of the infested bole, but the present hand equipment (spray pumps and extension rods) provides effective spray to a height of only about 27.5 feet. Therefore, if brood above this point is to be killed, the tree must be felled to complete the treatment; this is both expensive and time-consuming.

Selection of trees to be felled and treated is left to the discretion of the crew leader. Even a well-trained crew leader cannot accurately estimate the height of attack. Consequently some trees are felled unnecessarily and, conversely, some trees are not felled that should be; this results in missing brood more than 27.5 feet above ground. Obviously, a more reliable means of estimating height of attack would greatly improve both quality and effectiveness of a control project. Analysis of several hundred infested trees has demonstrated a relation between tree diameter and height of attack.

METHODS

A study to determine whether a relationship existed between diameter at breast height and height of attack was conducted from 1956 through 1959. Data were collected during chemical control operations on the Teton National Forest in 1956 and on the Wasatch National Forest in 1958. In the project areas, 513 infested trees were sampled to obtain data on diameter at breast height, height of tree, and height of attack by mountain pine beetle. During 1959, diameter was measured and height of attack was recorded on 236 infested trees. These data were taken during biological surveys on the Teton, Ashley, and Wasatch National Forests, and on Grand Teton National Park.

RESULTS

Analyses of data show a definite correlation between diameter at breast height and height of attack by mountain pine beetle in the lodgepole pine stands where these data were obtained. The correlation analysis shows an 'r' value of 0.4497 for all 749 infested trees sampled. This correlation appears quite satisfactory when we consider that the samples represent a wide range of ecological conditions. All years and areas of study showed correlation as good as or better than that for the total samples. As tree diameter increases, the height of attack increases. Also--and probably more important--as the diameter increases, the percent of infested trees containing brood higher than 37.5 feet above ground increases even more markedly.

Figure 1 shows the percent of trees sampled that contained infestations above or below the dividing line (27.5 feet) by diameter class. Of all trees sampled, 46 percent had attacks above the effective spray limit. In the 8- to 9-inch diameter class only 6 percent of the infested trees contained brood above the spray limit. However, approximately two-thirds of the trees 14 inches d.b.h. and larger had brood above the height for effective spraying.

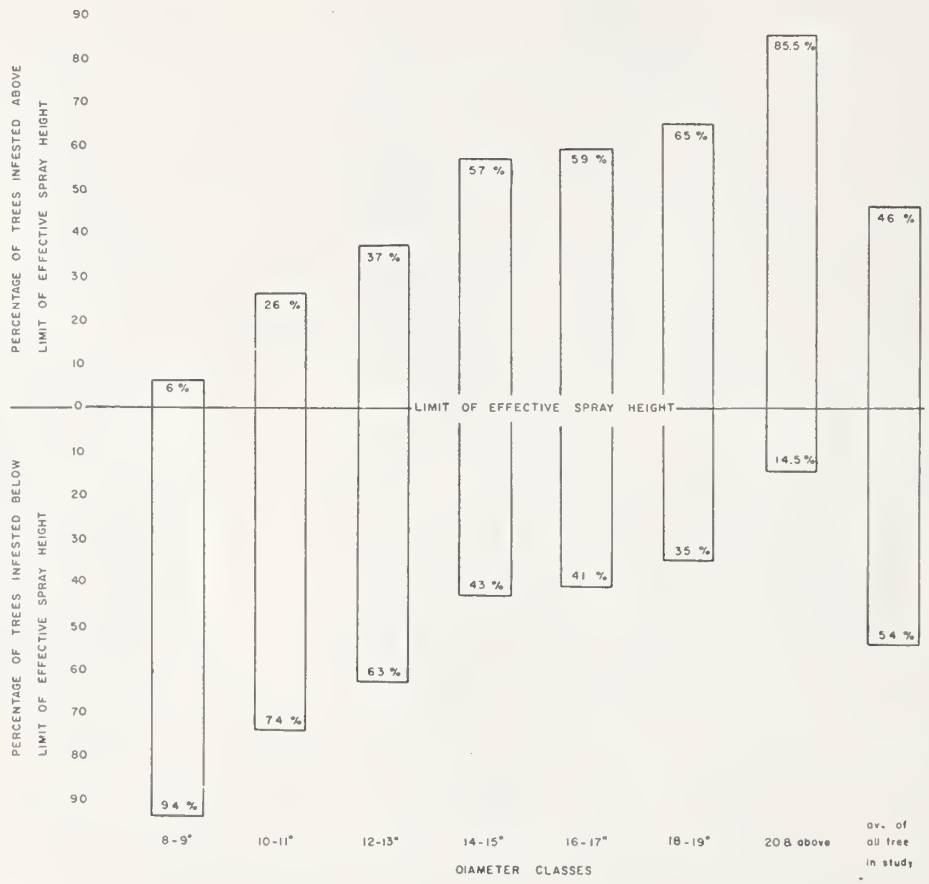

Figure 1.--Percentage of trees infested above or below the effective spray height by diameter classes.

Of these trees, 42 percent had brood more than 10 feet above the height for effective spraying. In the 12- to 13-inch class, 37 percent of the trees had been attacked above spray limits; the maximum height of attack was more than 60 feet above ground (fig. 2).

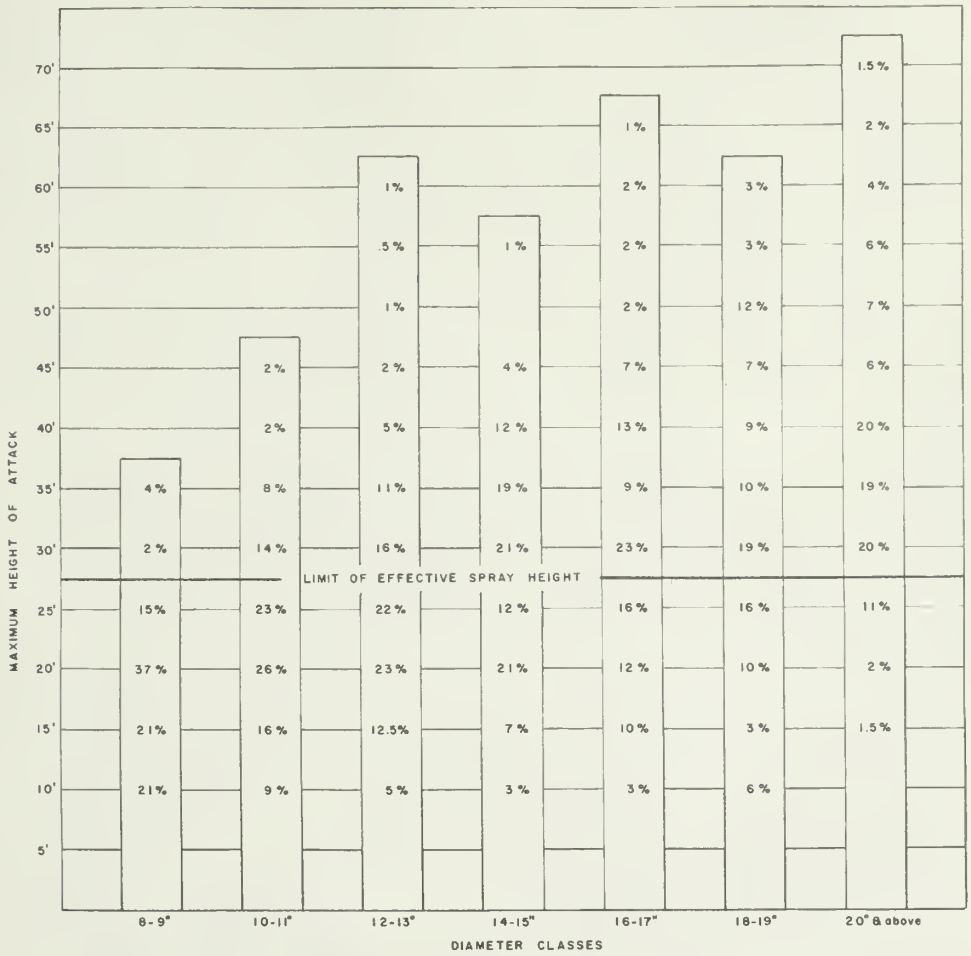

Figure 2.--Maximum height of attack expressed as percentage of trees within diameter classes.

DISCUSSION

The results of this analysis have several uses in planning a control project. The fact that a correlation exists between diameter at breast height and height of attack should aid a project director in planning, organizing, and directing his project more effectively. Knowledge of the d.b.h. of the infested trees and the remaining green trees is essential. This could be obtained readily by recording the d.b.h. of all infested trees tallied and of 1 percent of the green trees, in the fall operational surveys. With this information available a project director can better estimate the size, type, and cost of a control operation than he could previously. For example, if the survey showed that in a given unit most of the infested trees were less than 14 inches d.b.h., the project leader would probably decide to fell all infested trees larger than 10 inches d.b.h. with the idea of cleaning up the area as soon as possible. This would be especially desirable if most of the uninfested trees were 10 inches d.b.h. or larger.

In another unit, 60 percent of the infested trees might be 14 inches d.b.h. and larger, and a high proportion of green trees might be in the larger diameter classes. In such a unit it is obvious that all of the larger infested trees should be felled to achieve effective control.

Another possible condition might be that (1) most of the infested trees were 14 inches d.b.h. or larger, (2) that most of the larger diameter trees had already been killed, and (3) the remaining green trees were smaller than 10 inches d.b.h. In such an area, the land manager may decide it would be more economical to treat infested trees standing and plan to complete coverage of the unit in 2 or more years.

The size of the probable project, limitations of time and manpower, and the proportion of infested trees in each diameter class could influence the selection of diameter limits above which trees will be felled.

Once the land manager has determined, for each unit, what trees, if any, are to be felled, he can estimate his needs for manpower, insecticide, and equipment more accurately. Furthermore, each treating crew can be told to fell all infested trees larger than the prescribed diameter for the unit. This provides a definite guideline and sets standards for supervisory inspections.

DPS, Ogden, Utah